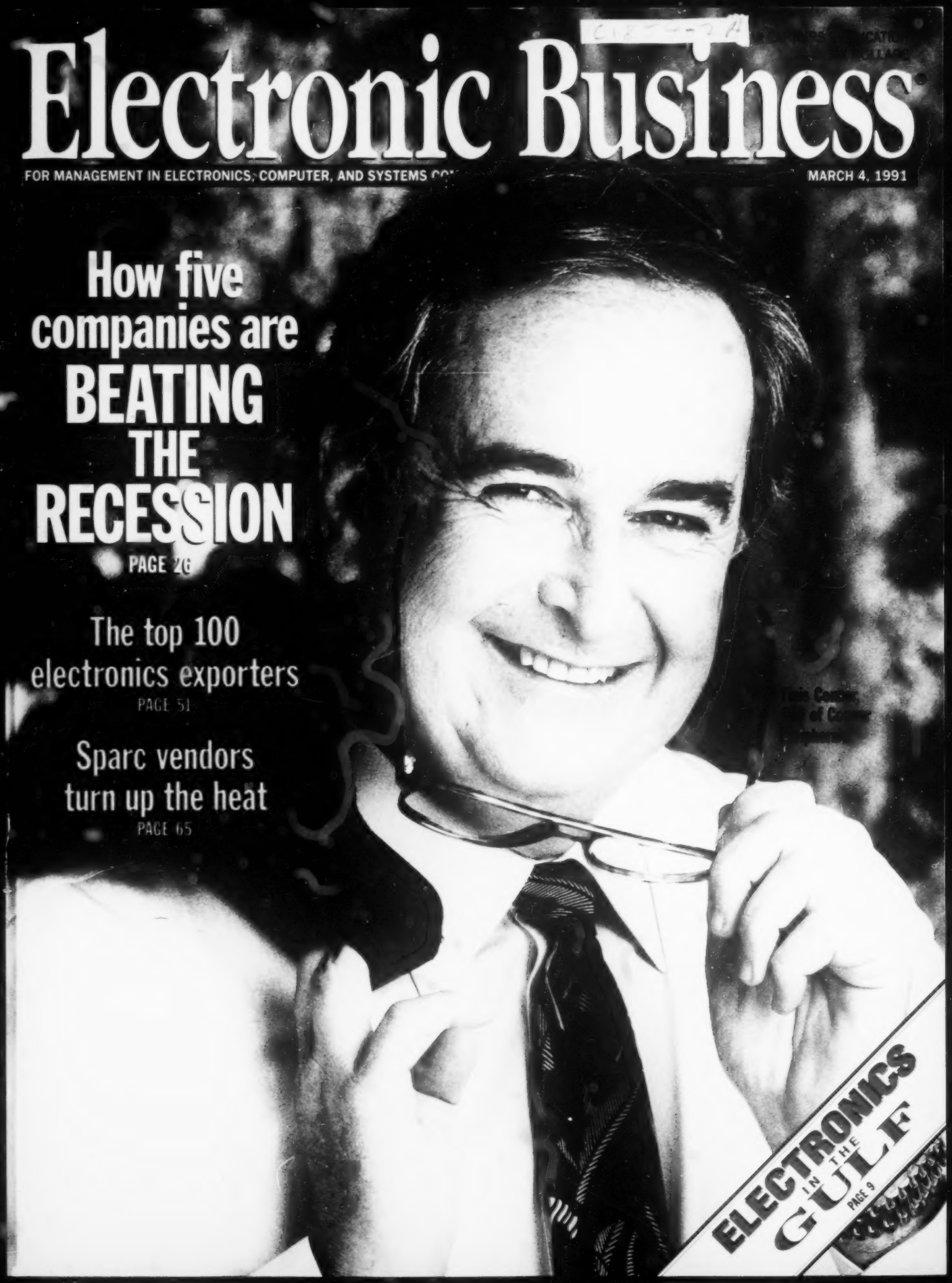
Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYSTEMS CO

MARCH 4, 1991



How five companies are BEATING THE RECESSION

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The top 100 electronics exporters

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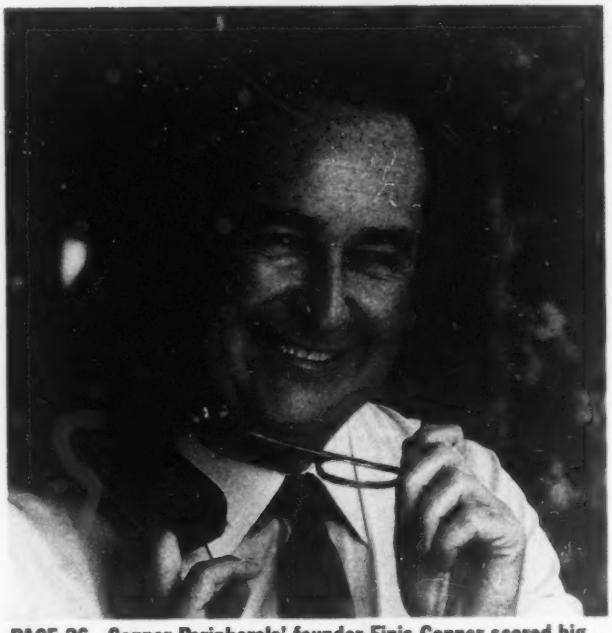
Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 17, NO. 5 MARCH 4, 1991



PAGE 26 Conner Peripherals' founder Finis Conner scored big by teaming up with a major customer right from the start

Cover: Christopher Springmann

COVER STORY/BEATING THE RECESSION

26 How five companies are beating the recession

In just about every recession, it seems a few executives don't get the word. Against all odds and despite the economic downturn, five electronics companies in particular—Altera, Borland International, Conner Peripherals, Stratus Computer, and Xilinx—continue to be spectacularly profitable. Is it simple dumb luck, or are these companies doing something right?

UPDATE

9 Electronics in the Gulf
Given the stunning accuracy of Allied weapons in the Gulf, you'd never know that many are being used for the very first time. Much of the credit goes to simulators that allow pilots to practice their missions before leaving the ground

15 Business Trends
Deals with Soviets prove disappointing; Analog adopts distribution policy; Computer Bowl sees East-West faceoff; start-up delivers PC image compression; DEC prognosis is better than expected; quality tops Marshall agenda; South Korean demand for components rises; flat semiconductor market for Italy; Ericsson's stake in Orbitel proves profitable; an industry giant is gone

COVER STORY/BEATING THE RECESSION

26 How five companies are beating the recession
For several months now, the U.S. electronics industry has been awash in pink slips and red ink. But some companies are laughing off the downturn and have managed to stay afloat. How are companies such as Altera, Borland International, Conner Peripherals, Stratus Computer, and Xilinx riding high while the competition is running for cover? In some cases, it's simply a matter of having the right product in the right place at the right time. But despite the negative environment that surrounds the industry, these five companies are holding their own and proving profitable in a tough market

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34 Intergraph still defending its contrary ways
After 21 years of steady growth, Intergraph insists on going its own way. The Huntsville, Ala., CAE/CAD/CAM company has broken many of Wall Street's most hallowed rules by clinging to what some claim to be an outdated strategy based on proprietary turnkey systems. But billion-dollar Intergraph shows no signs of backing down. Maybe the company knows something the industry doesn't. Or maybe it's simply out of touch

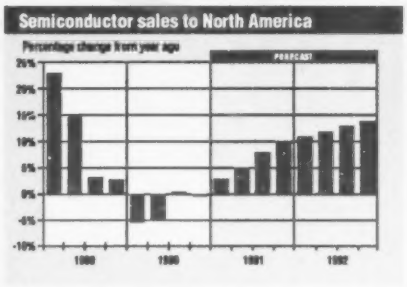
MANAGING RESOURCES

45 Small suppliers join the ranks of U.S. exporters
With sluggish domestic markets and a weakening dollar, international markets have taken on a certain allure for U.S. electronics companies. But for many would-be exporters, overseas expansion raises many more questions than it answers. A growing array of federal and state services, private consultants, and international representatives can make the decision a little easier

PAGE 45 "Most small companies are afraid to get started in international markets. They're afraid it will cost too much and they won't get paid," says Bart Hazleton, president of Bison Instruments

PAGE 34 Intergraph's CEO James Meadlock: Four years later and still profitable

PAGE 65 Sun's Bill Keating: "It is a fatal mistake for Sparc vendors to compete head-on with Sun on price"



PAGE 74 Semiconductor sales expected to rise

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MANAGING RESOURCES

51 **Electronics exports boost the U.S. bottom line in 1989**
The surge of overseas sales by U.S. companies has helped close the trade gap, according to ELECTRONIC BUSINESS' exclusive survey of the top 100 U.S. electronics exporters. But the accelerating move to offshore production could result in a somewhat different story by this time next year

EUROPE BUSINESS

57 **Sagging profits spark identity crisis at Nokia**
Oy Nokia, Finland's top electronics company, may be in trouble. Among the company's four core businesses, only telecommunications and mobile phones are profitable; consumer electronics and computers are less optimistic. Nokia now must slash its costs, develop new outlets, and identify its role in the global electronics market

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61 **Hong Kong in 1997: What if it works?**
In just six years, Hong Kong is scheduled to be repatriated to mainland China. In the meantime government, business, and technology leaders are doing everything they can to ensure that the nation takes its place as one of the Pacific Rim's most powerful electronics competitors

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Three years ago, Sun took a gamble with its Sparc-based systems. Now, apparently, the risk is paying off, and Sun is ready to take on the competitors who plan to go head-to-head on price. Given Sun's resources, predicts a company source, it will be an uphill battle

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Lessons in beating the odds

It's always fun to hear about someone who is beating the odds. Maybe it's the 45-year-old mother of four who finally picks up her college degree after 20 years of night school. Or it's the company that scores big in a depressed market while the competition is scrambling for shelter.

Senior editor Linda Stallmann

Take Intergraph. By Wall Street's reckoning, writes associate editor Peter Burrows, this supplier of CAD/CAM/CAE systems should have gone belly-up years ago. Not only does the company sit in splendid isolation in Huntsville, Ala., but CEO James Meadlock insists on a proprietary turnkey approach that everyone in the business describes as a death sentence.

Everyone, that is, except Intergraph and its customers. While Meadlock's strategy may seem outdated—even suicidal—in this era of open systems, the contrarian CEO is clearly doing *something* right: Intergraph has never had a losing quarter, enjoyed a 6% profit margin last year (beating out such favorites as Sun Microsystems), and is the world's only billion dollar company dedicated to CAD/CAM/CAE systems.

Hundreds of other companies prove there's more than one way to stack the deck when times are tough. As proof, don't miss senior editor Linda Stallmann's exclusive report on the top 100 U.S. electronics exporters. Working with obscure data (often disguised under cryptic headings in corporate annual reports), Linda's findings demonstrate that hard times at home often spell juicy opportunities abroad: Total 1989 exports by the top 100 rose 19% from the previous year, while total sales climbed by only 9%.

Then there are those companies that seem to have a hard time explaining just *why* they are riding high while so many competitors are on the skids. Contributing editor Nancy Rutter takes a look at this phenomenon in "How five companies are beating the recession."

Some of these companies appear to be doing well by design. Borland International's focus on technology leadership, for example, has helped the company turn a $6 million deficit into a $6 million profit in just two years. But for other companies—such as Stratus Computer, the pioneer of fault-tolerant online computing technology—success appears to be a matter of having the right product in the right place at the right time.

All in all, we think, a timely topic given the dark economic picture being painted for 1991. We hope you'll spend a little extra time with this issue of ELECTRONICS BUSINESS. Odds are you'll pick up more than a few tips on running your company smarter and more profitably.

H. GARRETT DeYOUNG, managing editor

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BPA ABP

Simulators win their wings in the Gulf

In the early days of the Vietnam War, pilots of Air Force F-105s were shot down over North Vietnam with tragic frequency. Because the planes were equipped with an early version of terrain-following radar that could spot enemy antiaircraft installations from afar, it was thought the planes could handle low-level missions to knock out hard-to-hit targets. But pilots lacked the practical training to read and react to the radar in the seconds it took before they flew into unfriendly skies.

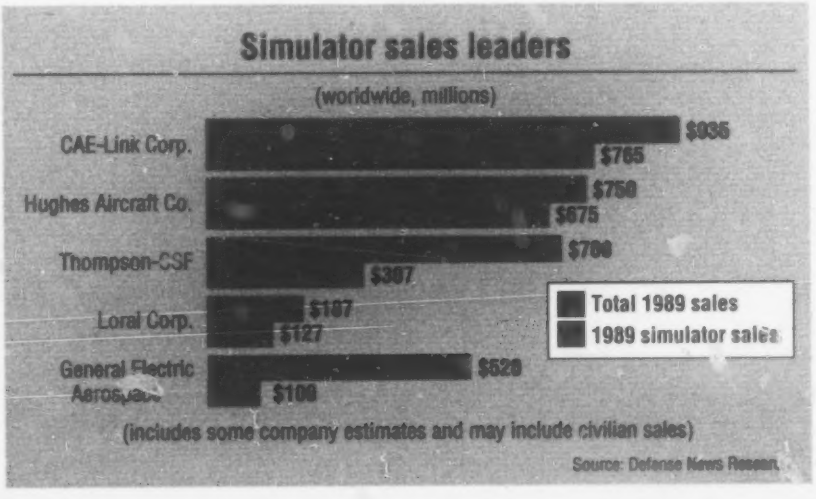
"Pilots came back screaming for training," says Jack Bradish, manager of strategy with Hughes Flight Simulation Operations in Herndon, Va. "You are already in mental overload when you're up there, and your reactions have to be automatic." Training came in the form of a simulated cockpit; losses soon plummeted.

Almost two decades later, the military world seems to have recognized the value of simulators. From four-story $40 million behemoths to mobile, PC-based battlefield systems, military simulators made up a $1.09 billion business in 1990, according to New York-based Frost & Sullivan Inc. Growth has been brisk for contractors such as market leader CAE-Link Corp. in Binghamton, N.Y., General Electric Co.'s aerospace division in King of Prussia, Pa., and hardware vendors such as Evans & Sutherland Corp. in Salt Lake City and Encore Computer Corp. in Ft. Lauderdale, Fla.

The payoff can be clearly seen in the Persian Gulf. Airmen, who may have fired no more than one real missile in years of training, struck Iraqi targets with surgical accuracy. Patriot missile launchers, who had never actually fired one of the $500,000-plus devices, consistently knocked Scud missiles out of the sky. Electronic jamming and surveillance systems, never used in combat, were employed with stunning precision.

The electronics industry can claim much of the credit for the improved effectiveness of simulators. Instead of "flying" over cardboard landscapes, simulator pilots now fly over vast software-created areas. Rather than practice one's skills in a static setting, instructors now make use of burgeoning computer power and database technology to throw a myriad of problems at trainees—including engine problems, bad weather, wind shear, and even enemy fire.

Sitting in the cockpit of such a simulator is no day at the arcade. In a typical aircraft simulator, trainees wear "G" suits that simulate the affects of gravity during maneuvers at supersonic speed. Synthesizers mimic the roar of the wind and the scream of departing missiles. Some systems sit on motion platforms that try to duplicate the turbulence of combat.



Lessons from the Gulf

But simulation is going beyond just the teaching of individual skills. Various projects have made it possible to link groups of simulators to more accurately recreate the complex coordination needed in wartime. At the Army base in Ft. Knox, Ky., up to 80 tanks can "run" missions together through a DARPA-devised link called SIMNET. Another Army program in Ft. Rucker, Ala., lets teams of various helicopters face off in highly realistic war games.

Given the remarkable coordination of the Allied attack in the early weeks of the Gulf war, some say the dividends of these efforts are already with us. One achievement, called "mission rehearsal," may prove especially invaluable. By downloading worldwide weather forecasts and satellite reconnaissance into specially equipped simulators, pilots reportedly have been able to run through missions hours before taking to the air.

Pilots are not the only beneficiaries of simulation; the nation benefits as well. Because of the prohibitive price, range, and destructiveness of today's weapon systems, simulation has become a critical means to test, analyze, and define the nation's defenses. "We are not only in the business of saving lives but also of saving money and the environment," says Bradish.

But simulation has not been immune to military cost cutting. Sales of simulation equipment and services by U.S. Department of Defense prime contractors fell from a high of $1.82 billion in 1985 to $1.09 billion in 1989, Frost & Sullivan reports.

Spending on military simulators should continue to dip for the next few years, as resources are diverted to pay for the war and to refurbish the national arsenal. But most observers expect the segment to outpace the rest of the defense industry after that. "As you reduce the size of your military budget, it becomes even more important that all your troops are well trained," notes retired General Robert Reed, now executive director of the National Training Systems Association in Arlington, Va.

PETER BURROWS

EXPORTS

Electronics exports boosted the U.S. bottom line in 1989

A surge in offshore sales by U.S. companies helped close the trade gap, but foreign production could slow the pace of exports

BY ELIZABETH B. BAATZ

Despite the negative impact of a strengthening dollar, 1989 shipments by the top 100 U.S. electronics exporters rose 19% above 1988 levels, while total electronics sales by those companies grew just 9%. According to an exclusive ELECTRONIC BUSINESS survey, those 100 companies exported $33.4 billion worth of products in 1989—nearly 21% of all domestic and foreign electronics sales.

Not surprisingly, the largest companies contributed the most to the gain. The five largest U.S. electronics exporters shipped $14.4 billion of products and services, accounting for 43% of the total value of exports; together, the top 10 contributed 59% of the total value.

The ELECTRONIC BUSINESS survey of exports is limited to U.S. companies that derive at least 50% of their revenue from electronics. Exports include both direct sales to foreign customers and intracompany transfers to non-U.S. operations. U.S. sales are direct sales to U.S. customers from U.S. sites plus exports from U.S. sites.

IBM topped the list of leading U.S. electronics exporters with $5.5 billion in overseas sales, or 16% of electronics exports by the top 100. Hewlett-Packard, Motorola, and Digital Equipment each exported more than $2 billion in 1989.

The survey also identified the fastest-growing exporters. Top honors went to Sensormatic Electronics Corp. of Deerfield Beach, Fla., a producer of security systems for retail and industrial markets. Sensormatic exports rose more than 400%, from $9.2 million in 1988 to $48 million in 1989, thanks largely to the company's new Singapore subsidiary and expanded Far East distribution and procurement networks. Conner Peripherals Inc. of San Jose ranked second among the fastest-growing exporters with a 322% gain, due to inroads into Japan. Computer and systems makers Dell Computer, Concurrent Computer, and Teradata rounded out the five fastest-growing exporters.

Interestingly, some companies pulled back on exports during 1989. Exports by Micropolis Corp. in Chatsworth, Calif., for example, fell by nearly 50%. At the same time, Tandon cut back by 38%.

As a share of U.S. sales, Atari Corp. was tops with 88% of all U.S. sales making their way abroad. (The figure is deceptive, however, since Atari's exports are counted after the company imports product into the U.S. from its production facilities in the Far East.) Other companies whose exports ran more than 50% of their U.S. sales include Tandon, Datapoint, Burr-Brown, Measurex, and Chips and Technologies.

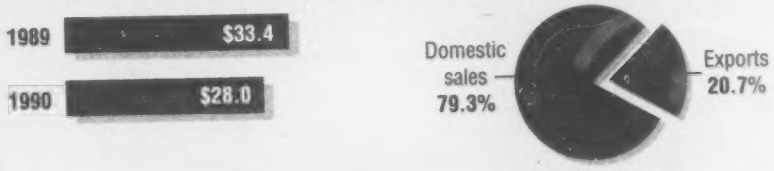
Future export patterns are far from clear. Despite nationalistic concerns in Washington and throughout industry, top U.S. electronics companies are moving their production closer to their foreign customers, and that could alter their export data. Tandon Corp., for example, shipped exports worth 64% of its U.S. sales in 1989. Late that year, however, the company transferred its production from California to Vienna and now produces almost all the products it sells to Europe in Europe. □

Senior editor Linda Stallmann and assistant editor Xiong Xiaoge contributed to this report.

Electronics exports at a glance

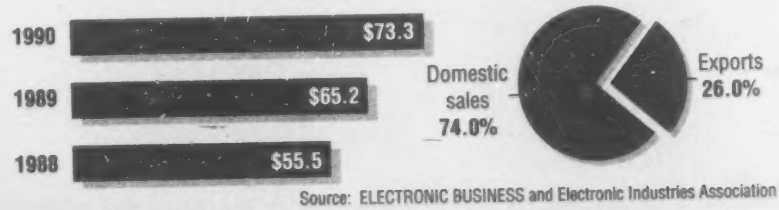
Top 100 electronics companies

(value of exports in billions exports as a share of U.S. sales in 1989)



Total electronics industry

(value of exports in billions exports as a share of U.S. sales in 1990)



Source: ELECTRONIC BUSINESS and Electronic Industries Association

Top 100 electronics exporters

Rank	Company	1990 Exports ($ millions)	% change	1990 Exports as a % of U.S. sales	Rank	1988 Exports as a % of U.S. sales	Rank	1990 U.S. sales ($ millions)	1990 Total sales ($ millions)	ELECTRONIC BUSINESS 200 Rank
1	IBM	$5,476.0	10.6%	17.5%	73	16.4%	65	$31,221	$62,710	1
2	Hewlett-Packard	2,634.0	27.6%	32.1%	34	30.2%	30	8,195	11,899	5
3	Motorola	2,319.0	33.1%	28.5%	44	24.8%	45	8,123	9,620	8
4	Digital Equipment	2,103.3	4.2%	26.4%	49	25.8%	43	7,952	12,742	3
5	Unisys	1,906.5	-5.3%	27.1%	48	27.3%	38	7,043	10,097	7
6	GM Hughes	1,530.4	10.2%	13.5%	84	12.3%	83	11,359	11,359	6
7	Raytheon	1,340.0	2.5%	16.3%	78	17.2%	62	8,215	8,796	14
8	Intel	997.9	7.8%	36.0%	23	36.1%	14	2,773	3,127	23
9	Compaq	796.9	47.3%	33.7%	29	29.9%	31	2,367	2,876	27
10	Xerox	770.0	93.0%	6.3%	96	3.6%	99	12,312	17,635	4
11	Sun Microsystems	751.0	99.1%	42.5%	12	36.8%	13	1,765	1,765	39
12	Apple	558.3	34.1%	16.4%	77	15.0%	70	3,401	5,284	13
13	NCR	483.0	6.6%	16.5%	76	15.5%	67	2,925	5,956	12
14	Control Data	460.0	-9.6%	15.9%	80	14.2%	78	2,897	2,935	24
15	Tektronix	458.1	19.4%	37.4%	17	32.9%	20	1,226	1,433	47
16	Atari	449.6	18.7%	88.2%	1	76.2%	2	510	424	100
17	Tandem Computers	421.3	30.5%	34.9%	26	33.4%	18	1,208	1,633	41
18	Amdahl	414.6	61.1%	27.8%	47	20.1%	57	1,491	2,101	38
19	National Semiconductor	405.9	31.9%	30.9%	38	27.8%	36	1,314	1,648	43
20	Varian Associates	402.0	21.8%	33.1%	32	32.0%	23	1,214	1,344	48
21	Conner Peripherals	388.2	321.6%	49.0%	9	31.4%	25	792	705	73
22	Advanced Micro Devices	362.5	-35.5%	38.7%	15	46.6%	7	936	1,105	57
23	Wang Laboratories	332.1	33.9%	19.2%	68	14.2%	77	1,734	2,869	31
24	Data General	290.8	5.7%	30.1%	39	27.2%	39	967	1,314	51
25	Texas Instruments	272.0	2.3%	5.7%	98	5.7%	93	4,747	6,522	10
26	General Instrument	252.7	21.2%	19.2%	67	16.8%	63	1,317	1,377	49
27	Intergraph	243.2	10.2%	34.8%	27	32.6%	22	699	860	69
28	Cray Research	239.2	16.0%	33.0%	33	29.4%	33	724	785	71
29	Western Digital	236.6	88.3%	38.3%	16	33.3%	19	618	992	60
30	AMP	234.7	34.3%	15.5%	81	12.5%	82	1,517	2,797	33
31	Honeywell	220.6	14.7%	4.8%	100	4.4%	96	4,568	6,059	11
32	Teradyne	217.1	2.8%	44.9%	10	45.7%	9	484	484	87
33	Microsoft	214.0	49.5%	36.9%	19	31.7%	24	579	804	61
34	Storage Technology	204.6	38.1%	24.3%	56	19.8%	59	841	841	59
35	Applied Materials	191.9	41.8%	52.3%	8	45.8%	8	367	502	83
36	Computer Associates	181.8	47.7%	24.7%	54	23.7%	47	735	1,030	52
37	Harris	178.5	33.2%	9.2%	92	7.9%	90	1,936	2,214	30
38	Foxboro	172.0	27.0%	36.5%	21	33.8%	16	472	598	116
39	E-Systems	163.3	9.0%	10.0%	90	10.4%	84	1,626	1,626	46
40	Novell	146.6	35.6%	34.8%	28	31.2%	27	422	422	97
41	Maxtor	142.3	64.8%	33.6%	30	27.5%	37	423	351	93
42	Loral	137.9	23.4%	11.6%	88	9.8%	85	1,187	1,187	54
43	3Com	135.0	77.8%	36.2%	22	31.0%	28	373	386	104
44	Wyse Technology	134.4	22.9%	29.9%	40	24.0%	46	450	452	91
45	Medtronic	129.9	26.2%	23.1%	59	21.5%	55	562	742	75
46	Gerber Scientific	127.1	6.4%	42.5%	13	45.2%	10	299	299	134
47	Tandon	125.6	-37.9%	63.5%	2	83.6%	1	198	289	114
48	Chips and Technologies	124.0	56.6%	57.0%	6	56.0%	6	218	218	150
49	Micron Technology	117.4	24.6%	26.3%	50	31.4%	26	446	446	106
50	Perkin-Elmer	114.7	29.8%	23.3%	58	20.9%	56	493	784	74

(continued)

Top 100 electronics exporters

Rank	Company	1990 Exports ($ millions)	% change	1990 Exports as a % of U.S. sales	Rank	1989 Exports as a % of U.S. sales	Rank	1990 U.S. sales ($ millions)	1990 Total sales ($ millions)	ELECTRONIC BUSINESS 200 Rank
51	Analog Devices	$108.9	14.2%	32.0%	35	29.6%	32	$341	$453	92
52	Scientific-Atlanta	107.3	46.8%	19.6%	66	14.4%	75	547	547	79
53	Symbol Technologies	99.3	NA	53.0%	7	NA	—	187	222	170
54	Ast Research	90.5	40.3%	21.0%	65	16.5%	64	430	457	88
55	Silicon Graphics	89.4	112.8%	35.9%	24	28.7%	34	249	264	122
56	Watkins-Johnson	88.6	35.5%	41.8%	14	30.3%	29	212	311	129
57	VLSI Technology	87.2	82.4%	33.5%	31	23.5%	46	261	288	138
58	Stratus Computer	78.6	48.7%	25.4%	52	21.7%	54	309	341	123
59	Burr-Brown	77.1	-0.4%	58.8%	4	53.7%	4	131	169	197
60	MAI Basic Four	70.8	-14.1%	29.5%	42	34.2%	15	240	397	112
61	Westmark International	70.6	46.4%	18.2%	71	15.6%	66	388	439	95
62	Sprague Technologies	70.0	-13.6%	28.5%	45	28.2%	35	245	344	121
63	Datapoint	68.5	-21.3%	60.6%	3	62.9%	3	113	313	142
64	Oracle	67.1	85.3%	18.2%	70	19.6%	60	369	584	72
65	Quantum	64.5	55.5%	31.0%	37	22.0%	52	208	208	109
66	Dell Computer	63.5	227.0%	17.4%	74	8.2%	89	364	389	111
67	Measurex	61.0	8.9%	58.2%	5	57.6%	5	105	285	141
68	Andrew	59.2	40.0%	25.6%	51	22.3%	51	232	302	125
69	Bicbold	57.2	29.5%	12.2%	87	9.8%	86	469	469	108
70	GenRad	55.7	24.9%	37.0%	18	26.0%	42	151	189	188
71	General DataComm	53.7	100.0%	29.7%	41	15.2%	69	181	201	179
72	Esterline	52.5	-11.3%	23.6%	57	26.0%	41	222	284	165
73	Archive	50.8	65.6%	28.0%	46	25.0%	44	181	181	186
74	International Rectifier	50.8	18.5%	35.9%	25	33.5%	17	141	195	175
75	Dynatech	50.5	7.5%	14.9%	82	14.9%	72	339	400	103
76	Genicom	50.4	38.5%	21.0%	64	14.9%	71	240	257	153
77	KLA Instruments	49.9	26.6%	36.6%	20	41.0%	12	136	165	198
78	Sensormatic Electronics	48.0	423.4%	24.6%	55	9.0%	87	195	151	196
79	Digital Communications	46.4	-6.5%	22.3%	62	21.8%	53	208	208	174
80	Cypress Semiconductor	45.8	43.0%	23.0%	60	23.0%	49	199	199	181
81	Coherent	45.5	24.9%	28.7%	43	26.3%	40	158	202	182
82	Vishay Intertechnology	43.4	76.0%	18.1%	72	22.7%	50	239	416	102
83	Integrated Device Tech.	41.6	71.6%	23.0%	61	20.0%	58	181	181	178
84	Intermec	41.2	34.0%	31.4%	36	32.8%	21	131	131	199
85	Kollmorgen	41.1	6.5%	22.2%	63	18.7%	61	185	228	177
86	M/A-Com	40.6	19.4%	9.9%	91	6.8%	88	411	441	96
87	Micropolis	40.2	-49.6%	44.6%	11	42.1%	11	90	307	132
88	Smith Corona	36.3	57.8%	7.0%	95	5.7%	94	515	493	101
89	Cubic	35.1	118.0%	10.0%	89	4.7%	95	349	349	126
90	SCI Systems	35.0	45.8%	5.2%	99	4.3%	97	667	987	56
91	Teradata	32.7	139.2%	25.1%	53	15.5%	68	130	137	193
92	Beckman	32.5	68.4%	5.8%	97	3.8%	98	559	786	70
93	ADC Telecommunications	31.3	19.8%	15.9%	79	14.5%	73	196	196	173
94	Everex Systems	26.6	53.4%	8.0%	93	7.4%	91	334	377	107
95	Recognition Equipment	25.6	32.9%	19.1%	69	14.4%	74	134	256	159
96	Tellabs	23.5	13.9%	14.6%	83	13.9%	79	161	161	191
97	Concurrent Computer	23.4	148.1%	12.3%	85	14.3%	76	190	278	120
98	Molex	23.2	10.2%	12.2%	86	12.6%	81	190	572	80
99	Ashton-Tate	23.1	-16.5%	16.7%	75	12.9%	80	138	265	148
100	Dataproducts	20.8	10.1%	7.5%	94	7.2%	92	278	353	124
	Totals:	$33,404.7	19.2%	20.7%		18.8%		$161,071	$230,792	

NA = Not available

Fueled by new software, Sparc vendors turn up the heat

Sun's risky gamble in opening Sparc is paying off. New systems and software are boosting the market. But price wars could backfire

BY DAVE WEBB

Three years ago, Sun Microsystems Inc. made a bold announcement of a risky strategy: Sun would convert from conventional CISC microprocessors to its newly developed Scalable Processor Architecture (Sparc) RISC design.

The news was greeted with something less than hearty applause and respect. Could this brash company successfully market a novel system design? Could Sun then build a broadly accepted standard in the marketplace by licensing Sparc to anyone? The answer is that Sun could, and has, done so.

Today it's hard *not* to applaud that strategy. Demand for Sun's Sparc-based systems has taken off. With more than 200,000 installed systems to its credit, the Sparc design is the dominant architecture in the $6.8 billion worldwide RISC (reduced instruction set computer) systems market. Following the rapid proliferation of Sparc-compatible systems and application software, Sparc may even rub out the remaining thin share of computers based on CISC (complex instruction set computer) technology in the workstation market.

International Data Corp. estimates that U.S. vendors of RISC-based workstations and servers will generate $6.8 billion in worldwide revenue this year, up from $4 billion last year. In 1990, Sparc-based computers made up 55% of all RISC systems shipped, IDC estimates. While Sparc-based systems do not generate as high a per-unit revenue average as Mips Computer Systems Inc. and other RISC-based systems on the market, at least $2 billion of all RISC computer sales in 1990 can be attributed to Sparc, based on Sun's revenue. However, Sun was the only significant system shipper last year. And there is much more to come.

At least 30 Sparc-compatible system vendors have announced products to date, with a flurry of introductions at the Comdex and UniForum trade shows. Before the end of last year, the only Sparc-compatible vendors actually shipping were Solbourne Computer Inc. and Toshiba Corp. Solbourne shipped about 1,000 units, and Toshiba only a few hundred. Solbourne makes high-end multiprocessing workstation systems and Toshiba sells a Sparc-based portable.

Sparc has also found its way into computer systems other than workstations. Star Technologies Inc. and ICL plc, for example, are marketing Sparc-based servers. Opus Systems Inc. sells a Sparc subsystem for boosting the performance of a PC, while later this year Force Computers Inc. will begin manufacturing Sparc-based VMEbus and Futurebus computer boards for embedded systems applications.

Sun's Bill Keating: "It is a fatal mistake for Sparc vendors to compete head-on with Sun on price"

Anchoring the high end of the Sparc market will be the Sparc version of the Model 500 supercomputer, which FPS Computing in Beaverton, Ore., plans to debut this year. That will complete Sun president and CEO Scott McNealy's vision of a Sparc universe stretching from laptops to supercomputers.

Not only has the number of Sparc-compatible manufacturers grown dramatically in recent months, but a flood of Unix-based application software is broadening the user base. Independent software vendors now regard the once application-poor Unix environment as a legitimate general-purpose operating system. Their efforts will, in turn, feed the fire and increase the demand for hardware. Sun's open Sparc strategy has lit a fire among hardware and software makers.

The list of Sun-approved application software packages has zoomed to over 2,000. Sparc International, a Sunnyvale, Calif.-based association of hardware and software vendors, claims that software developers are lining up to generate applications well beyond the usual Unix base of engineering, technical, and scientific applications.

Sun itself is making noises about addressing the commercial systems market, now served primarily by mainframe and minicomputer manufacturers. Sun intends to encourage not only new applications such as point-of-purchase and inventory management, but also personal productivity applications that typify the huge PC market. Sun has made no bones that it would like to see Sparc

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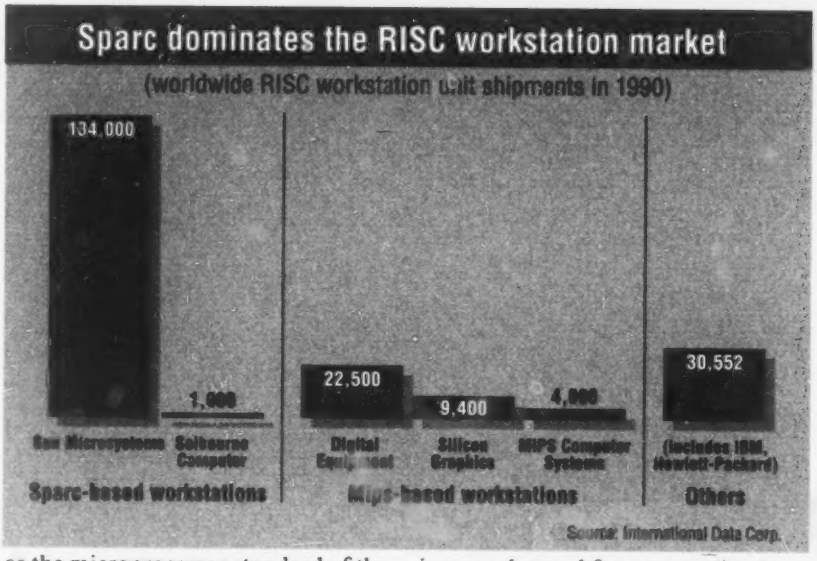

as the microprocessor standard of the 1990s, much like Intel's CISC chips were in the '80s.

Sun's tactic is to build a large enough installed base to attract application developers into these new areas for Unix. "The real thing we are pushing now is to see an increase in the number of independent software vendors," says Bob Duncan, chairman of Sparc International, who adds that Sun is being "very aggressive" to that end.

Sun's open Sparc strategy has lit a fire among hardware and software makers

Sparc-compatible vendors are breaking new ground in niche application markets that may ultimately be targets for Sun. The market is following Sun's strategy, according to Bill Keating, the company's director of corporate technology. The strategy is to build a large installed base and then allow clone makers and independent software vendors to leverage that base to develop other application areas. Then Sun may move in on those areas.

"We are using the Sparc-compatible [vendors] to build a stronger market," Keating says. "As the installed base of systems grows, there is more demand for new applications and software developers. The more ISVs we get, the more applications—and users—we get. It all sort of feeds upon itself."

To help establish Sparc as the microprocessor architecture of the '90s, Sun needs a major PC manufacturer to incorporate it into future products. Because IBM has its own RISC microprocessor, observers say a decision by Compaq Computer Corp. to adopt a RISC architecture will be a bellwether for the industry. Lately, Compaq seems to be trying to decide between Sparc and competing RISC chips from Mips. One key factor could be Microsoft Corp. The software giant plans to adapt its MS-DOS and OS/2 operating systems to an unnamed RISC chip. Microsoft's choice could make or break Sparc's chances of becoming the undisputed RISC leader.

But the Sparc system vendors may have a tough time emulating Sun's success. Most of the Sparc-compatible system vendors are more or less cloning Sun's low-end systems. International Data Corp. analyst Vicki Brown says makers are copying Sun's SparcStation 1 and 1+ systems with the intent to beat Sun on price. But Sun is hard to beat.

Sun's Keating claims vendors will make a fatal mistake in going head to head on price with Sun. "If they don't add value, competing against Sun is just an uphill battle," Keating argues. The problem is that Sun has an excellent distribution and support

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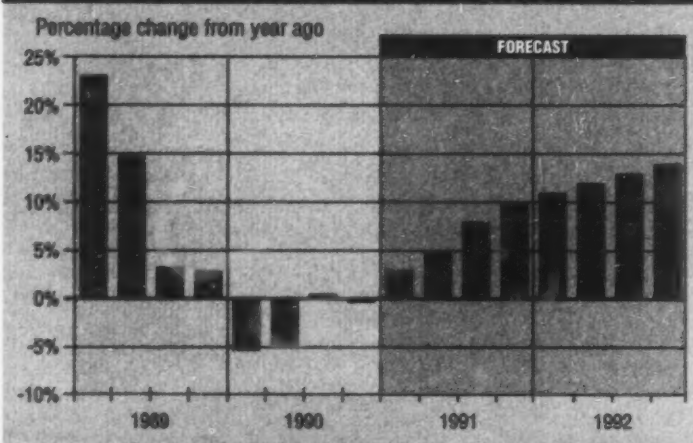
system in place. That relegates many of the me-too clone manufacturers—the ones aiming to market copies of Sun designs at lower prices—to channels that offer little, if any, technical support. Direct sales channels are costly and preclude competing on price with Sun.

"You are sort of caught between a rock and a hard place when it comes time to decide which channels to focus on," says Jay Prakesh, an industry analyst at Strategic Focus Inc. "You need a certain level of technical support for Unix, but can you afford to maintain it while competing on price? It is an issue that has yet to be resolved." That could drive several smaller Sparc vendors out of the market.

Solbourne is taking a different tack. "Solbourne is doing well due to its high level of service and support," says IDC's Brown. A few other companies, notably Mars Microsystems Inc. and Solarix Systems, are also trying a different path, targeting so-called "power DOS" users by coupling CISC coprocessors with Sparc chipsets. Such systems will run the huge array of shrink-wrapped DOS applications now available for PCs. "We were playing in a totally different market," says Mars co-founder Kevin Gonor, the company's vice president of sales and marketing. "We want to attack not just the workstation market but the desktop market as well. We want the user to run any DOS-based applications they had at 25 Megahertz plus be able to run the 2,100 software packages for Unix now available."

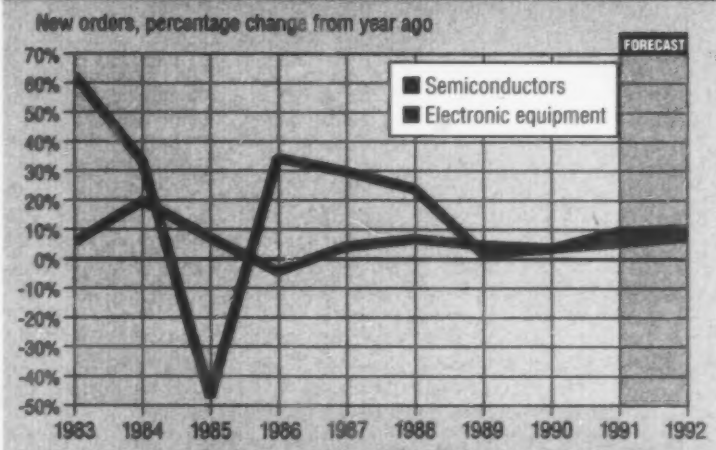
Nonetheless, Sparc still faces some potential obstacles. John Hime, vice president of marketing of Mips Computer Systems' system products group, is undaunted by Sparc's rise to workstation market dominance. "You have to consider Mips as having a much different strategy than Sun. Sun and Mips really play in different ballparks. I think in general [beyond the workstation market], we will address a much larger market," he says, predicting Mips could outpace Sun and its licensees by as much as a factor of 10, especially in the markets for embedded microprocessor control and high-end system applications. But for now Sun's Sparc strategy is paying off surprisingly well. □

Semiconductor sales to North America



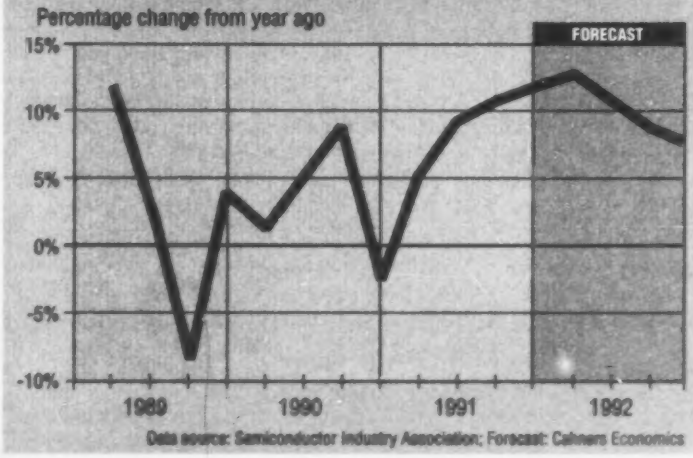
Data source: Semiconductor Industry Association; Forecast: Cahners Economics

Equipment orders drive semiconductors



Data source: SIA and U.S. Commerce Dept.; Forecast: Cahners Economics

Semiconductor bookings to North America



Data source: Semiconductor Industry Association; Forecast: Cahners Economics

Semiconductors expect higher growth in '91

The semiconductor industry remains weak, according to data from the Semiconductor Industry Association. Semiconductor sales to the North American market suffered two consecutive quarterly declines during the first half of 1990 and a 0.5% increase in the third quarter compared with the previous year; fourth-quarter sales dipped to $3.61 billion, 0.4% below the same period a year ago. For the twelve months ending in December, sales dropped 0.6% from the 1989 level, to $14.45 billion.

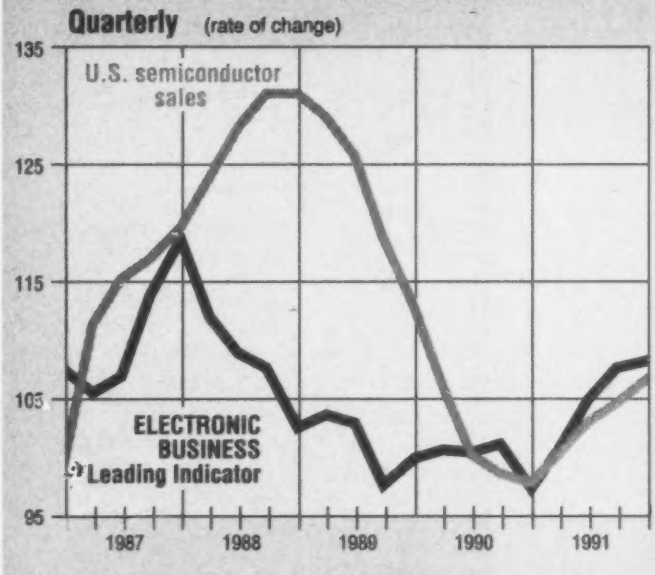
The sales dip is hardly good news for the industry. But if one compares the current industry downturn with the last electronics recession in 1985 (when sales plummeted 30% from the 1984 level), last year's 0.6% decline seems rather mild. And while fourth-quarter semiconductor orders recorded their first decline in a year (a 2.2% drop from a year ago), orders still managed to climb 3.4% for the entire year, to $14.95 billion.

It is still too early to tell how the Persian Gulf war will impact the semiconductor industry. Since the Iraqi invasion of Kuwait, however, new orders for electronic equipment have been shrinking, implying lower demand for semiconductor chips. Business confidence has also plunged and demand for all capital equipment has been weak since the invasion. Business confidence dropped from a peak of 65 in the third quarter of 1988 to a meager 24 in the final quarter of 1990, according to the Conference Board in New York. Economic uncertainty coupled with a weak economy clearly has caused many companies to put capital spending on hold.

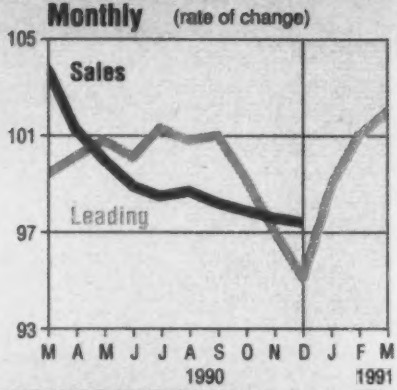
Still, Cahners Economics believes that this year will bring better news to the semiconductor industry. Lower interest rates and stronger investment in high-tech capital equipment will help fuel demand for chips. As electronic end-markets pull themselves out of this period of sluggish growth, the semiconductor industry will start to see strong gains. Cahners Economics now forecasts that both semiconductor orders and sales will rise in every quarter this year, achieving double-digit gains in 1992. Our outlook calls for new orders for semiconductors to increase 9.4% to $16.4 billion this year and swell 10.3% in 1992. Similarly, sales will rise 6.6% to $15.5 billion this year and surge 12.6% to $17.5 billion in 1992.

JULIE HANDELMAN

ELECTRONIC BUSINESS Leading Indicator



To obtain your complimentary copy of a backround paper on the ELECTRONIC BUSINESS Leading Indicator, please contact Linda Keehn, Cahners Economics, Cahners Publishing Co., 275 Washington St., Newton, MA 02158-1630 USA, telephone (617) 630-2119, fax (617) 630-2100.



The ELECTRONIC BUSINESS Leading Indicator (EBLI) dropped two points to 95.1 in December, dipping below the previous trough of 96.3 reached in September 1989. The EBLI was steadily rising from its previous low point, waffled in the first half of 1990, and reached a level of 101.3 in July. But after the August 2 invasion, an immediate downturn occurred, causing the indicator to veer off the path of our forecast. Once the uncertainty in the Gulf passes, the EBLI is anticipated to resume its slow growth pattern and will once again lead the activity of the electronics industry.

Source: Cahners Economics

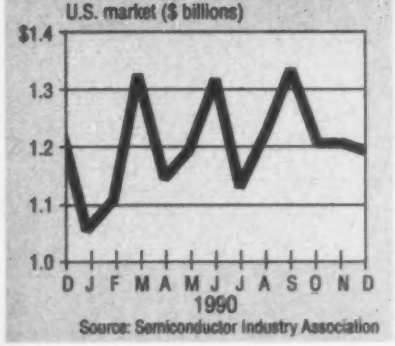
Electronics industry indicators this month

	Latest month	Previous month	Year ago	1989 average
ELECTRONIC BUSINESS Leading Indicator (rate of change, Dec.)	95.1	97.1	102.4	100.9
U.S. semiconductor bookings ($ millions, 3-month average, Dec.)	$1,157	$1,170	$1,183	$1,205
Weekly hours of semiconductor production workers (monthly average, Nov.)	40.6	40.0	41.1	40.1
Electronic components lead time index (1977 = 100, Jan.)	73.9	67.2	75.8	102.5
S&P's semiconductor stock price index (1970 =10, monthly average, Dec.)	57.4	54.9	57.9	54.7
Change in electronic components inventories ($ millions, SA, Nov.)	$52	$17	$27	-$12.8
Contracts and orders for plant and equipment ($ billions, SA, Nov.)	$39.5	$42.4	$43.9	$43.4

SA = seasonally adjusted, all other data are not seasonally adjusted

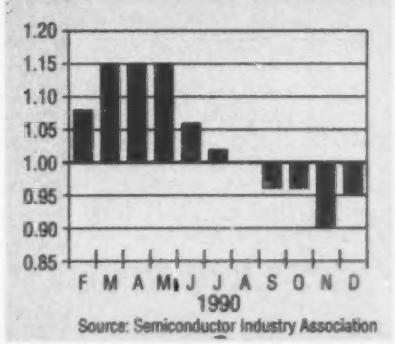
Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Department of Commerce , U.S. Bureau of Economic Analysis

Semiconductor sales



Source: Semiconductor Industry Association

Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Source: U.S. Commerce Department